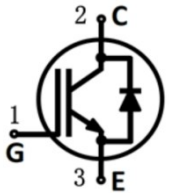
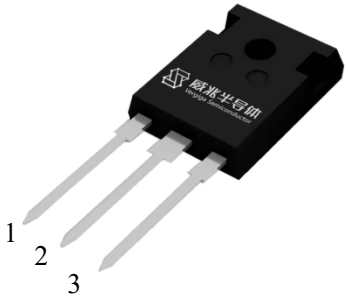
HCKW40N120H1 is a **1200V40A** IGBT discrete with high speed soft switching of Trench Field stop technology.The product with a anti-parallel diode,has the characteristics of low V_{cesat} , high junction temperature and strong robustness. It is very suitable for products with high switching frequency.

■ Features

- CoolWatt@Ⅰ Trench-FS technology
- Low V_{CESAT}
- Low switching losses
- With anti-parallel fast recovery diode
- Positive temperature coefficient
- High reliability





TO-247

■ Applications

- UPS
- Industrial welding
- SMPS

Part ID	V_{CE}(V)	I_{CNOM}(A)	$V_{CESAT@25℃}$(V)	Package	Marking
HCKW40N120H1	1200	40	1.85	TO-247	K40H1201

■ Maximum Rated Values

Symbol	Parameter	Condition	Value	Unit
V_{CES}	Collector-emitter voltage	T_{vj}=25℃	1200	V
I_C	DC collector current	T_C = 25℃ T_C =100℃	80 40	A
I_{Cpuls}	Pulse collector current	T_{vj}≤150℃	120	A
V_{RRM}	Repetitive peak reverse voltage	T_{vj}=25℃	1200	V
I_F	Diode continuous forward current	T_C = 25℃ T_C = 100℃	40 20	A
I_{Fpuls}	Diode pulse current	T_{vj}≤150℃	60	A

V_{GE}	Gate-emitter voltage	T_{vj}=25℃ Transient（tp≤10uS,D＜0.01）	±20 ±30	V
P_{tot}	Power dissipation	T_C = 25℃	484	W
T_{vj}	Operating junction temperature		-40~+175	℃
T_{stg}	Storage temperature		-50~ +150	℃
M	Mounting torque	M3	0.6	Nm

■ Thermal Characteristic

Symbol	Parameter	Maximum	Unit
$R_{thJC\text{-}IGBT}$	IGBT thermal resistance junction-case	0.31	K/W
$R_{thJC\text{-}FRD}$	FRD thermal resistance junction-case	1.20	K/W
R_{thJA}	Thermal resistance junction-ambient	40	K/W

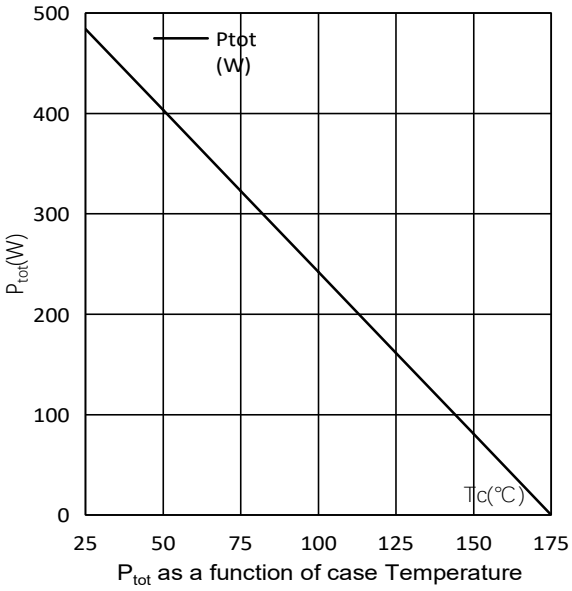
■ Electrical Characteristic

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)CES}$	Collector-emitter breakdown voltage	V_{GE} = 0V, I_C=0.5mA,T_{vj}=25℃	1200	—	—	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}=15V, I_C=40A, T_{vj}=25℃ T_{vj}=150℃	— —	1.85 2.25	2.20 —	
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{GE}= V_{CE},I_C=1.5mA,T_{vj}=25℃	4.80	5.60	6.40	
V_F	Diode forward voltage	V_{GE}= 0V,I_F=20A, T_{vj}=25℃ T_{vj}=150℃	— —	1.65 1.50	2.10 —	
I_{GES}	Zero collector voltage gate current	V_{GE}=30V,V_{CE}=0V	—	—	200	nA
I_{CES}	Zero gate voltage collector current	V_{CE} =1200V,V_{GE}=0V, T_{vj}=25℃ T_{vj}=150℃	— —	— —	0.25 1.00	mA
R_{Gin}	Integrated gate resistor	—	—	0	—	Ω
C_{ies}	Input capacitance	V_{GE} = 0V,V_{CE}= 30V, f = 1MHz, T_{vj}=25℃	—	4920	—	pF
C_{oes}	Output capacitance		—	186	—	
C_{res}	Reverse transfer capacitance		—	113	—	
Q_g	Gate charge	V_{GE}=0/15V,V_{cc}=960V,I_C=40A, T_{vj}=25℃	—	268	—	nC
Q_{ge}	Gate-emitter charge		—	37.9	—	
Q_{gc}	Gate-collector charge		—	143	—	
V_{GE}(pl)	Gate-emitter plateau voltage	I_C =40A,V_{CE}=960V, V_{GE}=0/15V,T_{vj}=25℃	—	8.53	—	V

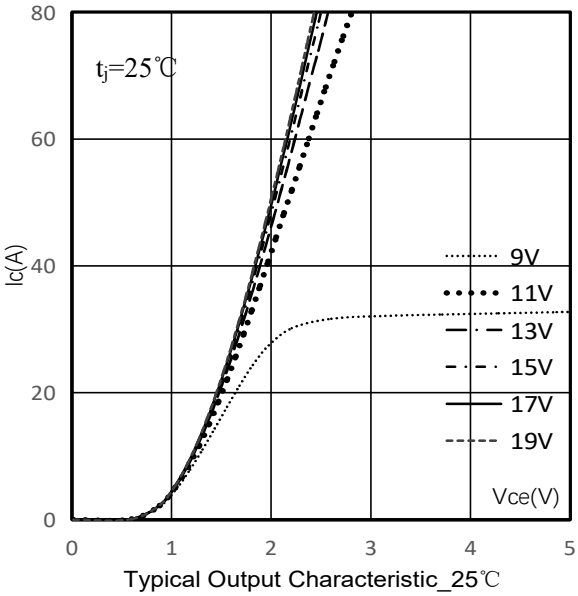
■ Dynamic Characteristic（With inductive load）

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
IGBT Characteristic_25℃：						
$T_{d(on)}$	Turn-on delay time	Vcc=600V,Ic=40A, Ron=10Ω, Roff=10Ω, Cge=0nF,V_{GE}=0/15V, L_{load}=100uH,T_{vj}=25℃	—	100	—	ns
T_r	Rise time		—	90	—	
$T_{d(off)}$	Turn-off delay time		—	316	—	
t_f	Fall time		—	44	—	
E_{on}	Turn-on energy		—	4.09	—	mJ
E_{off}	Turn-off energy		—	1.55	—	
E_{total}	Total switch energy		—	5.64	—	
IGBT Characteristic_150℃：						
$T_{d(on)}$	Turn-on delay time	Vcc=600V,Ic=40A, Ron=10Ω, Roff=10Ω, Cge=0nF,V_{GE}=0/15V, L_{load}=100uH,T_{vj}=150℃	—	380	—	ns
T_r	Rise time		—	88	—	
$T_{d(off)}$	Turn-off delay time		—	349	—	
t_f	Fall time		—	55	—	
E_{on}	Turn-on energy		—	5.86	—	mJ
E_{off}	Turn-off energy		—	1.82	—	
E_{total}	Total switch energy		—	7.68	—	
Diode Characteristic_25℃：						
Erec	Reverse recovery energy	I_F =40A,V_R=600V, V_{GE} =0/15V,R_{ON}=10Ω,T_{vj}=25℃	—	969	—	uJ
trr	Diode reverse recovery time		—	227	—	nS
Qrr	Diode reverse recovery charge		—	2970	—	nC
Irrm	Diode peak reverse recovery current		—	26.8	—	A
di_{rr}/dt	Diode peak rate of fall of reverse Recovery current during t_{rr}		—	236	—	A/uS
Diode Characteristic_150℃：						
Erec	Reverse recovery energy	I_F=40A,V_R=600V,V_{GE}=0/15V, R_{ON}=10Ω,T_{vj}=150℃	—	1890	—	uJ
trr	Diode reverse recovery time		—	364	—	nS
Qrr	Diode reverse recovery charge		—	5740	—	nC
Irrm	Diode peak reverse recovery current		—	34.8	—	A
di_{rr}/dt	Diode peak rate of fall of reverse Recovery current during t_{rr}		—	284	—	A/uS

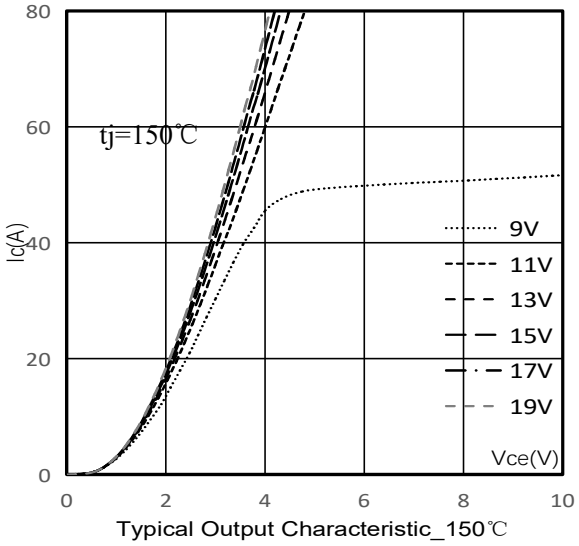
■ Characteristic Curve



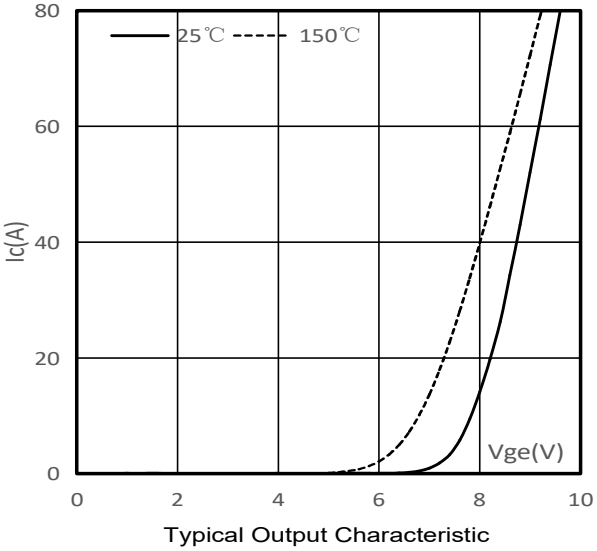
Ptot as a function of case Temperature



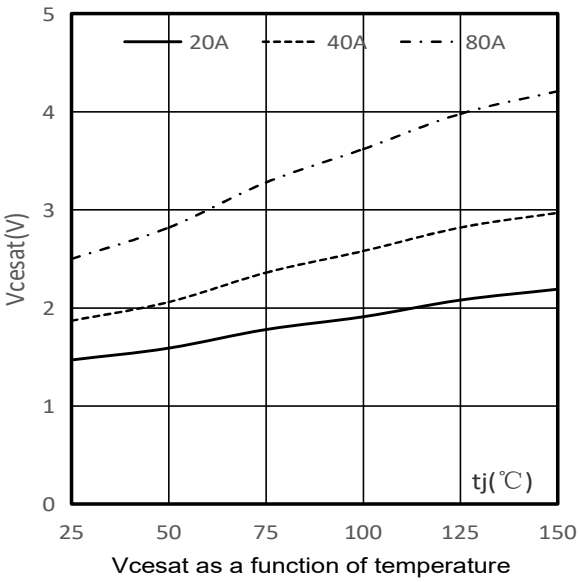
Typical Output Characteristic_25℃



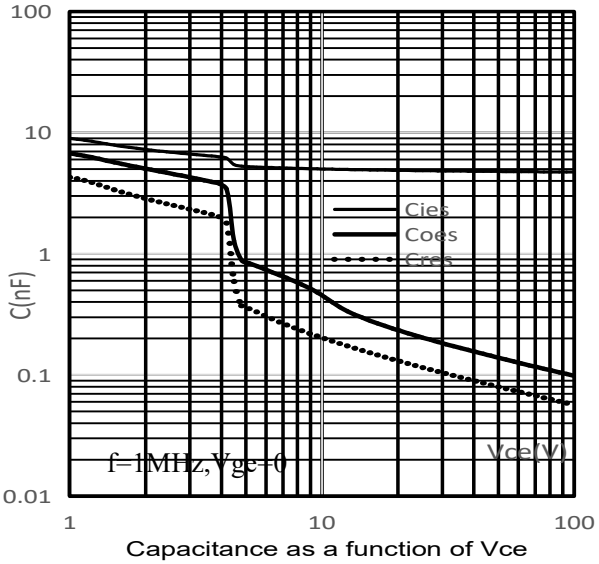
Typical Output Characteristic_150℃



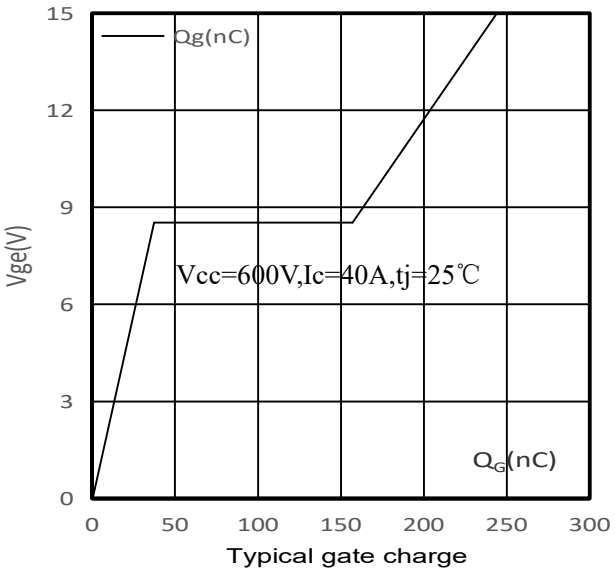
Typical Output Characteristic

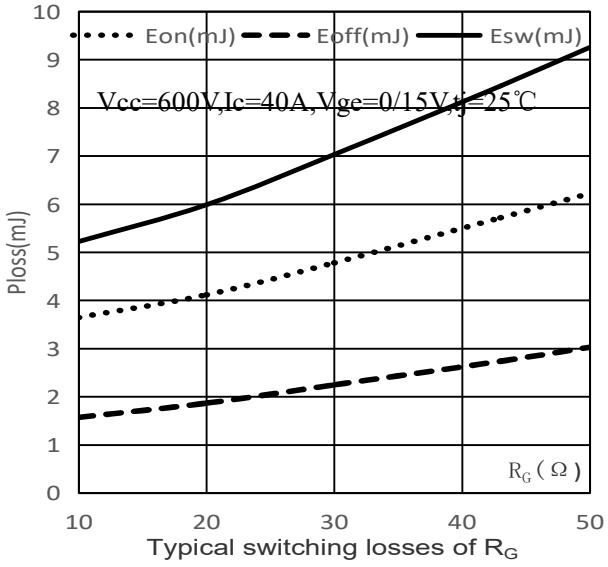


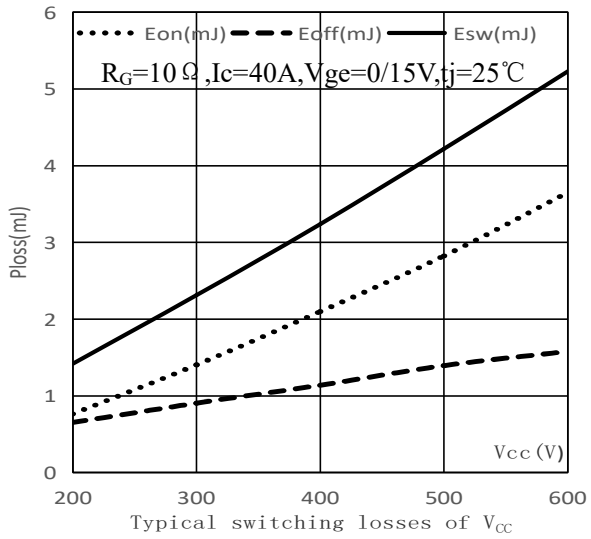
Vcesat as a function of temperature

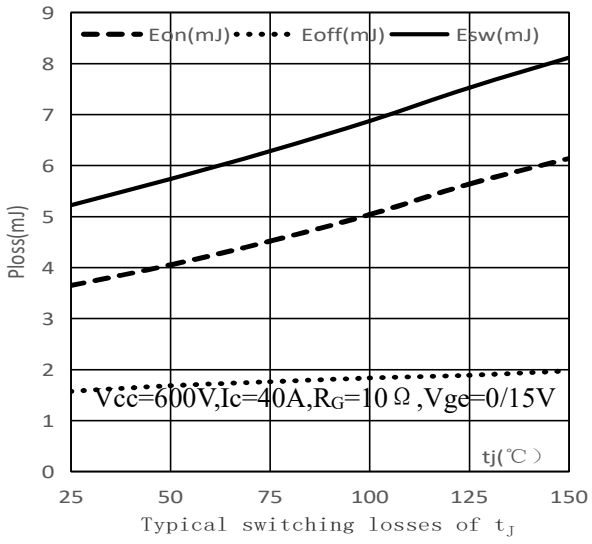


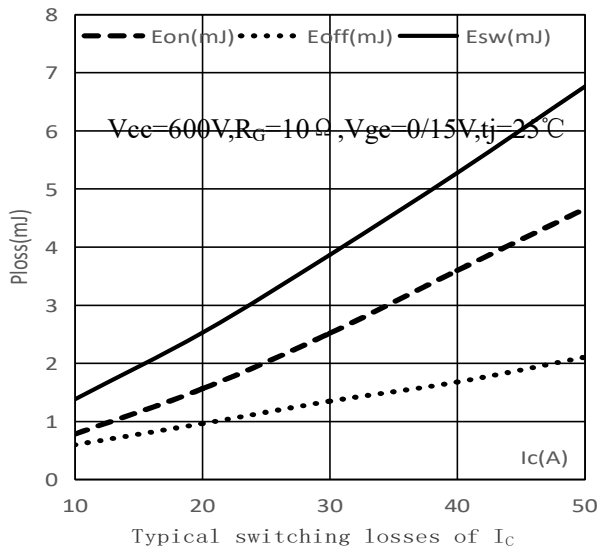
Capacitance as a function of Vce

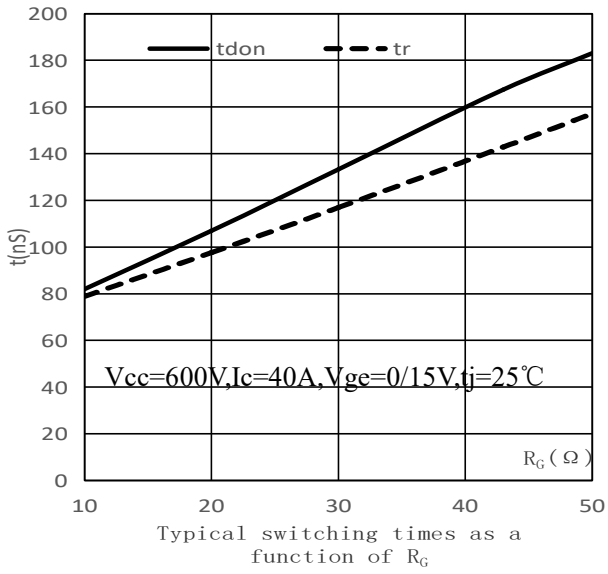

Qg(nC)
Vcc=600V,Ic=40A,tj=25℃
Vge(V)
Q_G(nC)
Typical gate charge

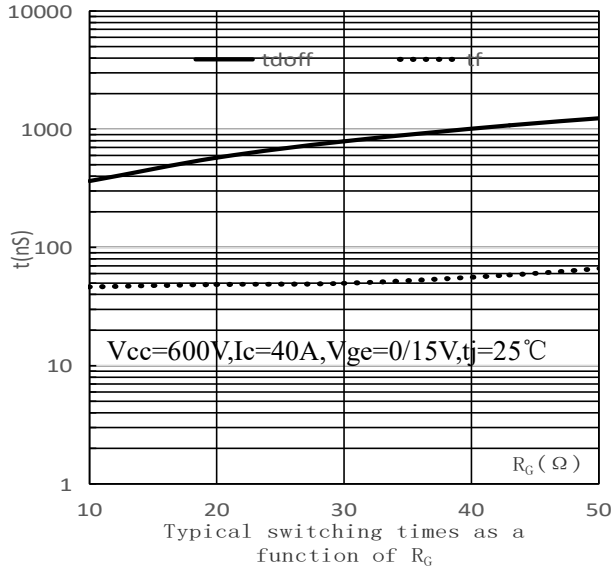

Eon(mJ)
Eoff(mJ)
Esw(mJ)
Vcc=600V,Ic=40A,Vge=0/15V,tj=25℃
Ploss(mJ)
R_G(Ω)
Typical switching losses of R_G


Eon(mJ)
Eoff(mJ)
Esw(mJ)
R_G=10Ω,Ic=40A,Vge=0/15V,tj=25℃
Ploss(mJ)
Vcc(V)
Typical switching losses of V_{CC}

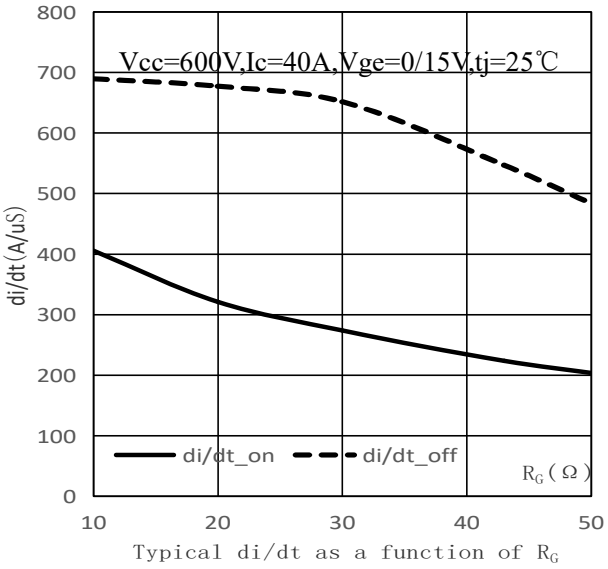

Eon(mJ)
Eoff(mJ)
Esw(mJ)
Vcc=600V,Ic=40A,R_G=10Ω,Vge=0/15V
Ploss(mJ)
tj(℃)
Typical switching losses of t_J


Eon(mJ)
Eoff(mJ)
Esw(mJ)
Vcc=600V,R_G=10Ω,Vge=0/15V,tj=25℃
Ploss(mJ)
Ic(A)
Typical switching losses of I_C

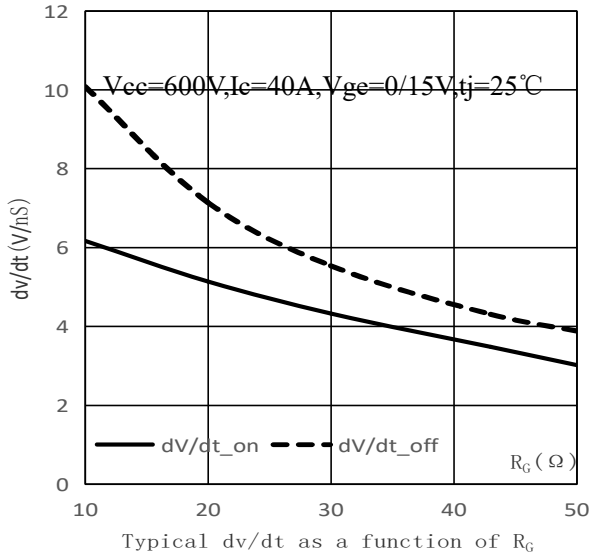

tdon
tr
Vcc=600V,Ic=40A,Vge=0/15V,tj=25℃
t(nS)
R_G(Ω)
Typical switching times as a function of R_G



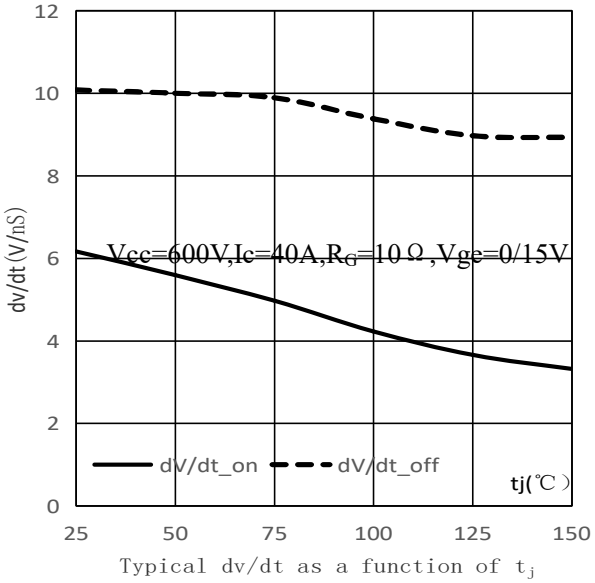
Typical switching times as a function of R_G



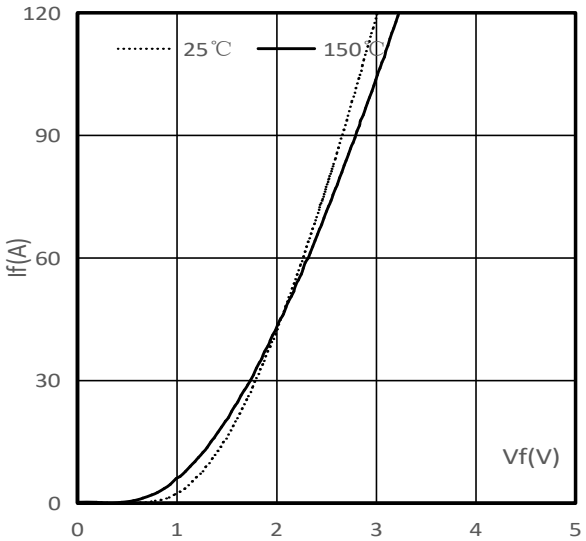
Typical di/dt as a function of R_G



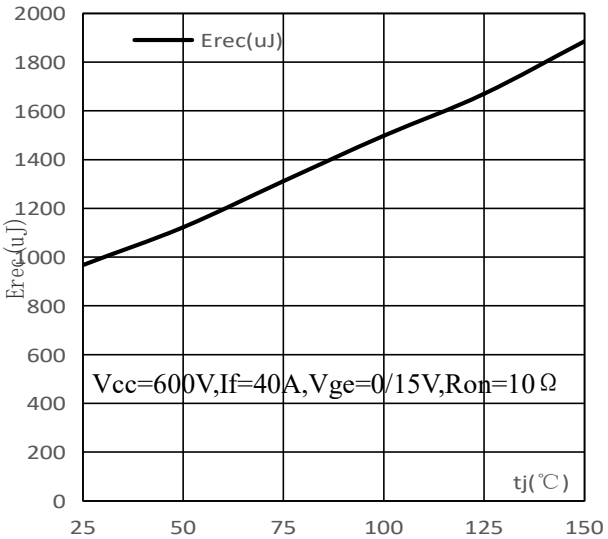
Typical dv/dt as a function of R_G



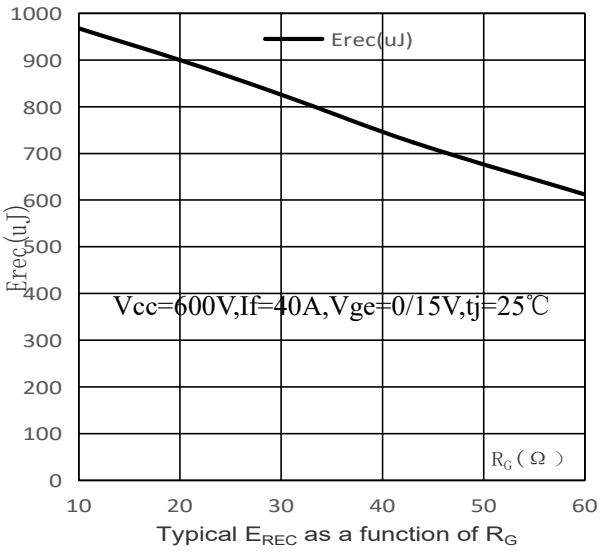
Typical dv/dt as a function of t_j



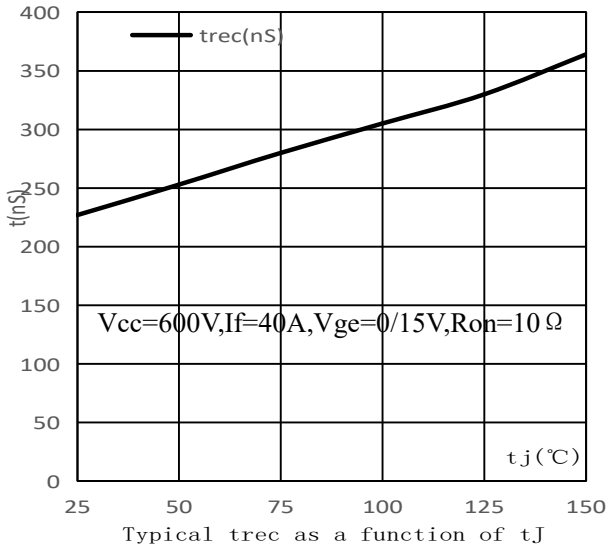
Typical I_F as a function of V_F



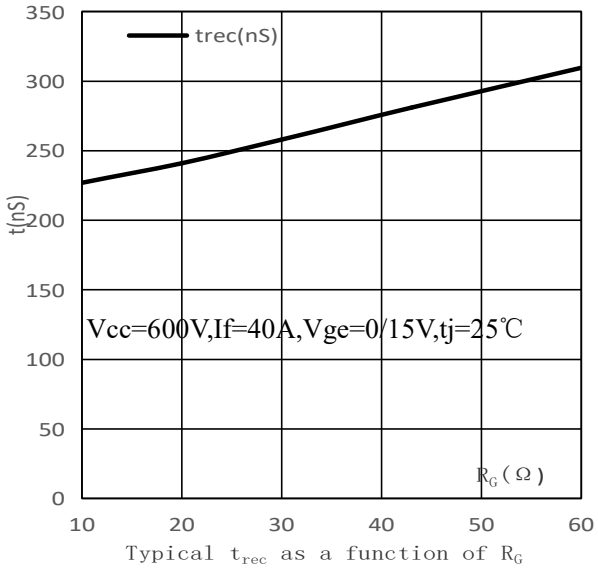
Typical E_{REC} as a function of t_J



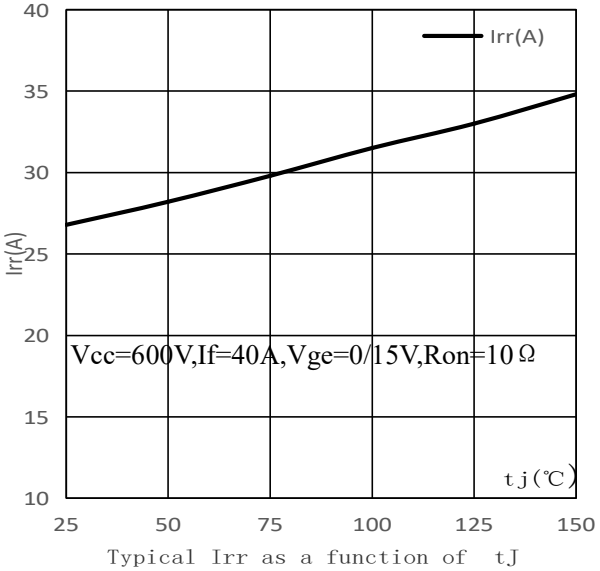
Typical E_{REC} as a function of R_G



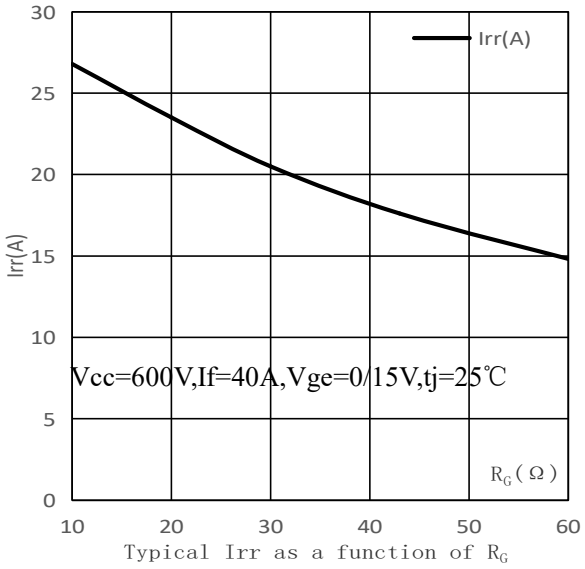
Typical trec as a function of tJ



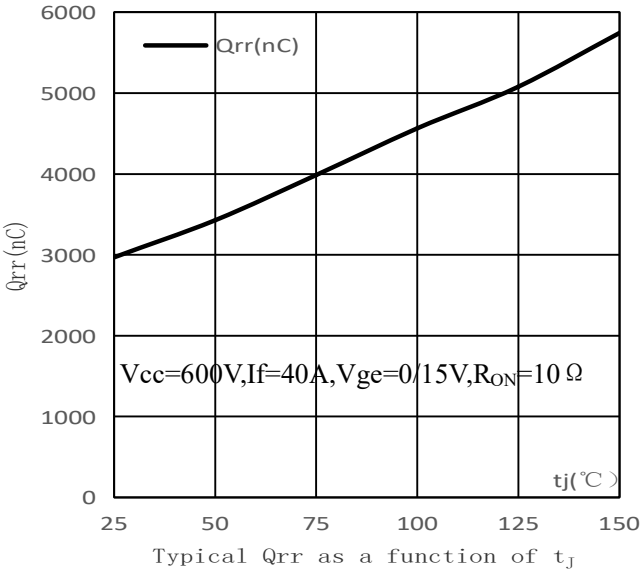
Typical t_{rec} as a function of R_G



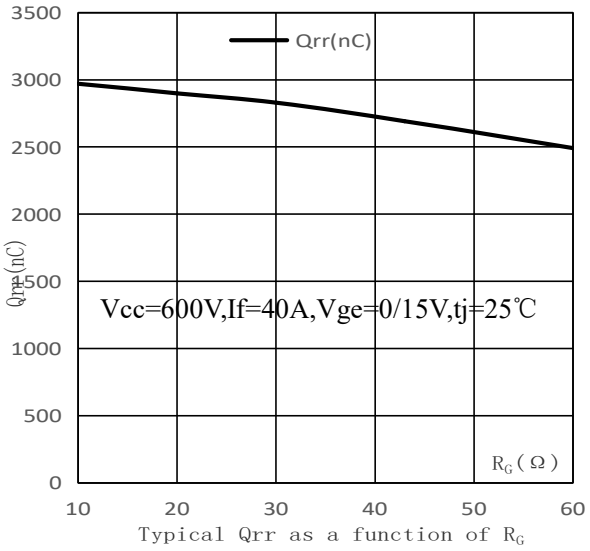
Typical Irr as a function of tJ



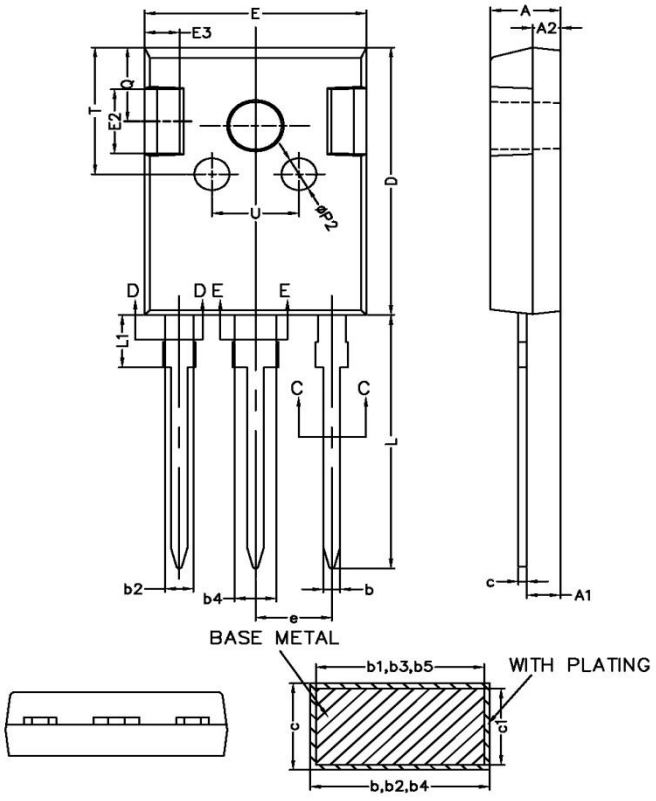
Typical Irr as a function of R_G



Typical Qrr as a function of t_J



■ Package Outline Data_TO-247



SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	–	0.15
a'	0	–	0.15
b	1.16	–	1.26
b1	1.15	1.2	1.22
b2	1.96	–	2.06
b3	1.95	2.00	2.02
b4	2.96	–	3.06
b5	2.95	3.00	3.02
b6	–	–	2.25
b7	–	–	3.25
c	0.59	–	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1	–	–	4.30
P	3.50	3.60	3.70
P1	–	–	7.40
P2	2.40	2.50	2.60
Q	5.60	–	6.00
S	6.05	6.15	6.25
T	9.80	–	10.20
U	6.00	–	6.40

Unit:mm