650V, 40A Trench Field Stop IGBT

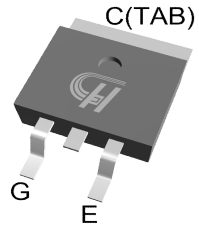
Features

* V_{CE}=650V, I_C = 40A
  $V_{CE(sat)}$=1.75V, I_C=40A,
* High breakdown voltage to 650V for improved reliability
* Trench-Stop Technology Offering:
  - -Very tight parameter distribution
  - -High ruggedness, temperature stable behavior
  - -High Speed Switching
  - -Low switching losses
  - -Easy Parallel Switching Capability Due to Positive Temperature Coefficient in V_{CEsat}
* TO263-2L Package

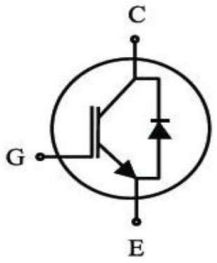
Applications

* Uninterruptible Power Supply (UPS)
* Welding Converters & Inverter
* Power Factor Correnction (PFC)
* Coverter with high switching frequency

Pin Description and Schematic



TO263-2L



Trench Field Stop IGBT

Package Marking And Ordering Information

Device	Marking [1]	Device Package	Quantity
HCR40T65DT63TR	HCR40T65D xx	TO263-2L	1600pcs/Reel

note 1. The 'HCR40T65D" is product type and the "xx" is date code.

ABSOLUTE MAXIMUM RATINGS (T_C = 25'C UNLESS OTHERWISE NOTED)

Parameter		Symbol	HCR40T65D	Unit
Collector-Emitter Breakdown Voltage		V_{CE}	650	V
DC Collector Current, Limited by T_{JMAX}	T_C=25'C	I_C	80	A
	T_C=100'C		40	
Diode Forward Current, Limited by T_{JMAX}	T_C=25'C	I_F	80	A
	T_C=100'C		40	
Continuous Gate-emitter Voltage		V_{GE}	±20	V
Transient Gate-emitter Voltage		V_{GE}	±30	V
Turn off safe Operating area V_{CE}≦650V, T_J≦150'C		-	160	A
Pulsed Collector Current, V_{GE}=15V, t_P limited by T_{JMAX}		I_{CM}	160	A
Power Dissipation, TJ=25'C		P_{tot}	197	W
Soldering temperature, wave soldering 1.6mm(0.063in.) from case for 10s		T_L	260	'C
Operating Junction Temperature Range		T_J	-40 to 175	'C
Storage Temperature Range		T_{stg}	-55 to 150	'C
IGBT Thernal Resistance, Junction-Case		R_{QJC}	0.76	K/W
FRD Thernal Resistance, Junction-Case		R_{QJC}	1.1	K/W
Thermal Resistance, Junction-to-Ambient(Maximum)		R_{QJA}	40.0	K/W

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Electrical Characteristics (TA = 25'C unless otherwise noted)

Parameter	Symbol	Test Conditions	HCR40T65D			Unit
			Min	Typ	Max	
States						
Collector-Emitter Breakdown Voltage	BV_{CES}[2]	V_{GE} 0V, I_C=250uA	650	-	-	V
Gate-Threshold Voltage	$V_{GE(th)}$	V_{GE}=V_{CE}, I_C=250uA	3.15	3.95	4.75	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=40A, T_J=25'C	-	1.75	2.3	V
		V_{GE}=15V, I_C=40A, T_J=175'C	-	2.20	-	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE}=650V, V_{GE}=0V, T_J=25'C	-	-	40	uA
		V_{CE}=650V, V_{GE}=0V, T_J=175'C	-	-	4000	uA
Gate-Emitter Leakage Current	I_{GES}	V_{CE}=0V, V_{GE}=±20V	-	-	400	nA
Transconductance	gfs	V_{CE}= 20V, I_C= 40A	-	38	-	S
Dynamic						
Input Capacitance	C_{IES}	V_{CE}= 30V, V_{GE}= 0V F=1MHz	-	2197	-	pF
Onput Capacitance	C_{OES}		-	84	-	
Reverse Transfer Capacitance	C_{RES}		-	12	-	
Gate Charge total	Qg	V_{CC}=520V,I_C=40A, V_{GE}= 15V	-	75	-	nC
Gate to emitter charge	Qge		-	13	-	nC
Gate to collector charge	QgC		-	35	-	nC
Turn-On Delay Time	td(on)	T_J=25'C, V_{CE}=400V,I_C=40A, V_{GE}=0.0/15V, R_G=10Ω	-	7	-	ns
Rise Time	tr		-	81	-	
Turn-Off Delay Time	td(off)		-	80	-	
Fall Time	tf		-	89	-	
Turn-on Energy	EON		-	1.35	-	mJ
Turn-off Energy	EOFF		-	0.62	-	
Turn-On Delay Time	td(on)	T_J=175'C, V_{CE}=400V,I_C=40A, V_{GE}=0.0/15V, R_G=10Ω	-	5	-	ns
Rise Time	tr		-	90	-	
Turn-Off Delay Time	td(off)		-	95	-	
Fall Time	tf		-	100	-	
Turn-on Energy	EON		-	1.5	-	mJ
Turn-off Energy	EOFF		-	0.83	-	
Dynamic						
Diode Forward Voltage	V_{FM}	I_F=40A, T_J=25'C	-	1.85	-	V
		I_F=40A, TJ=175'C	-	1.65	-	V
Reverse Recovery Time	trr	T_J=25'C I_F=40A, VR=400V, di/dt=760A/us	-	114	-	ns
Reverse Recovery Current	Irr		-	9.8	-	A
Reverse Recovery Charge	Qrr		-	0.57	-	uC

Note[2] BVces testing without filter could damage the device. BVces is guaranteed by Ices@650V test.

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Typical Characteristics (TJ = 25'C unless otherwise noted)

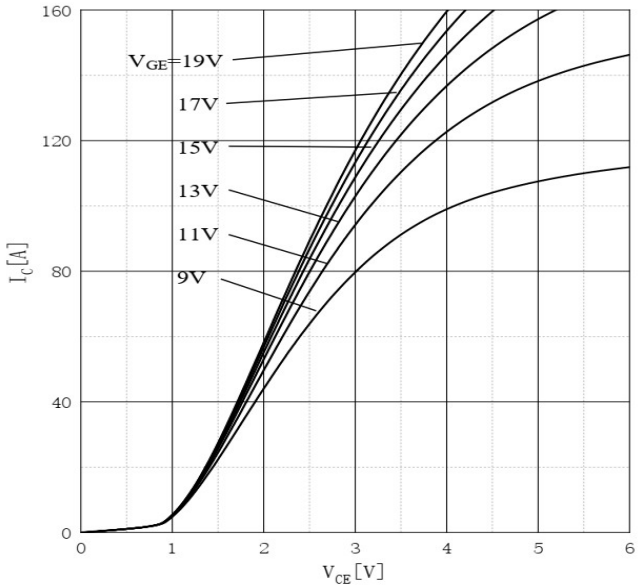

Figure 1. Output characteristic VCE vs IC at 25°C

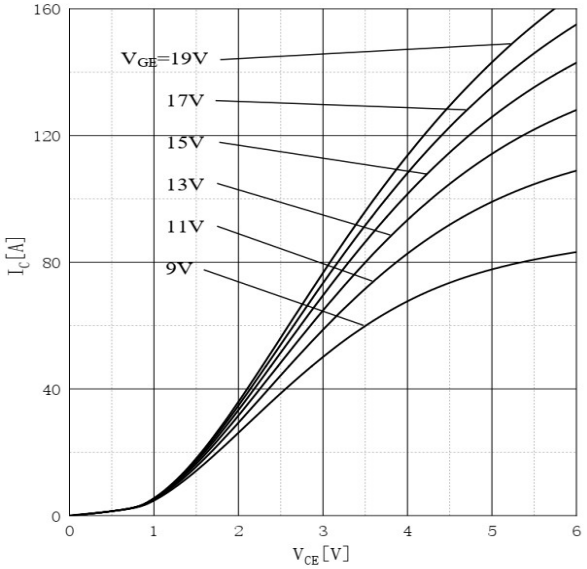

Figure 2. Output characteristic VCE vs IC at 175°C

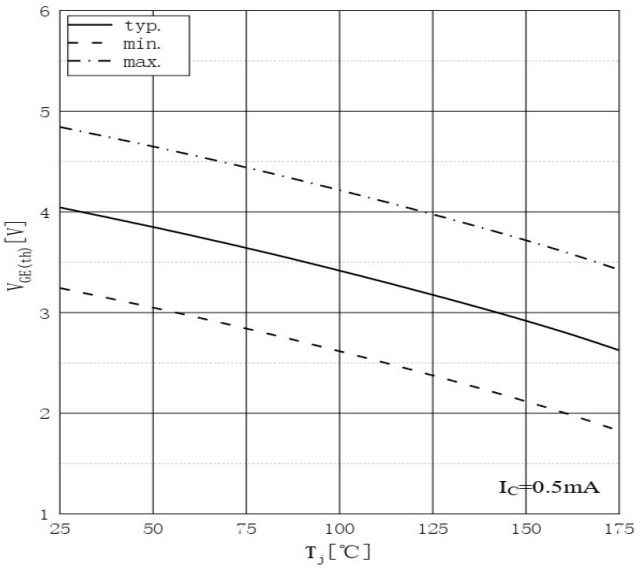

Figure 3. Gate-emitter threshold voltage as a function of junction temperature VGE(th) vs Tj

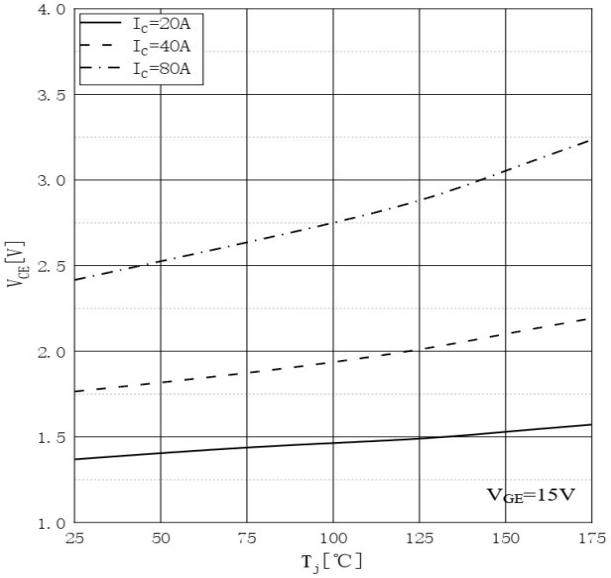

Figure 4. Collector-emitter saturation voltage as a function of junction temperature VCEsat vs Tj

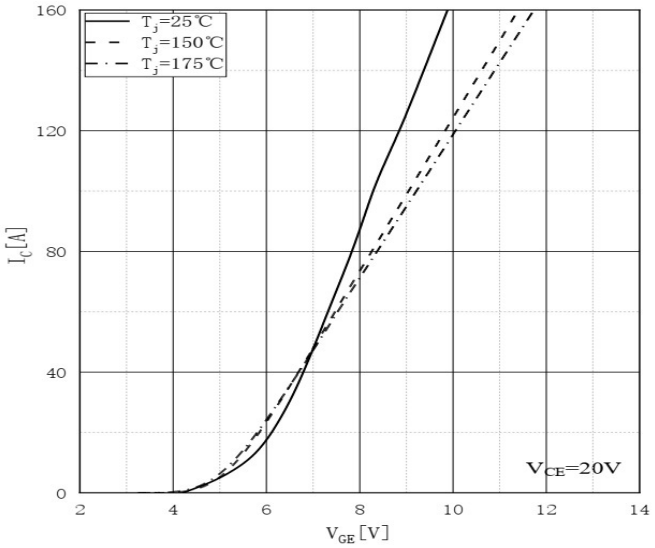

Figure 5. Transfer characteristic VGE vs IC

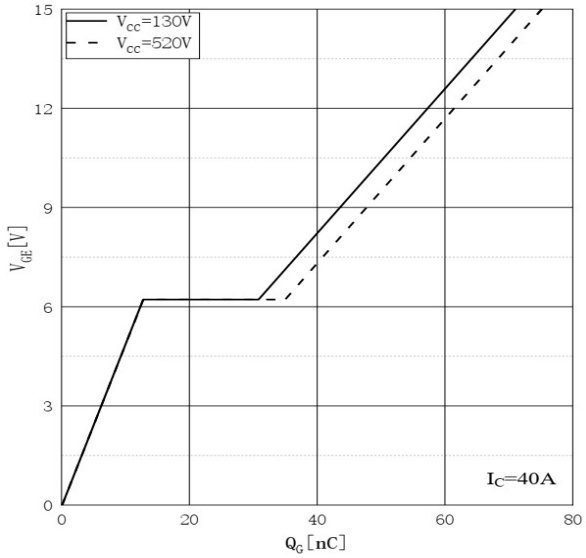

Figure 6. Gate charge QG

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Typical Characteristics (TJ = 25'C unless otherwise noted) (con.)

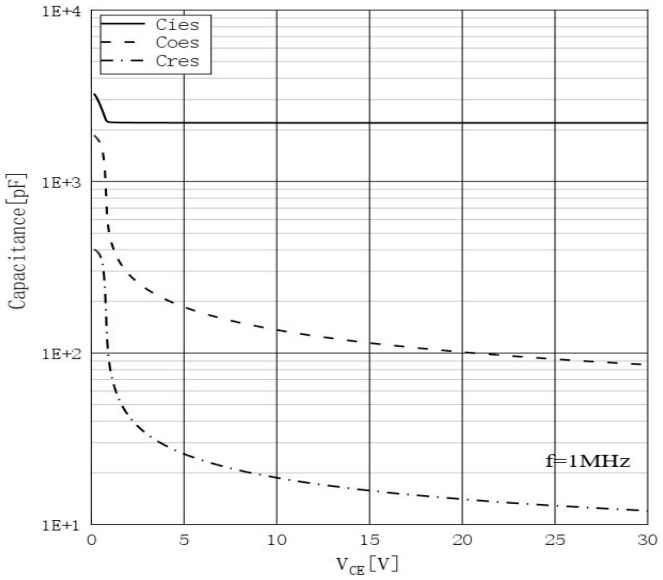


Figure 7. Capacitance characteristic

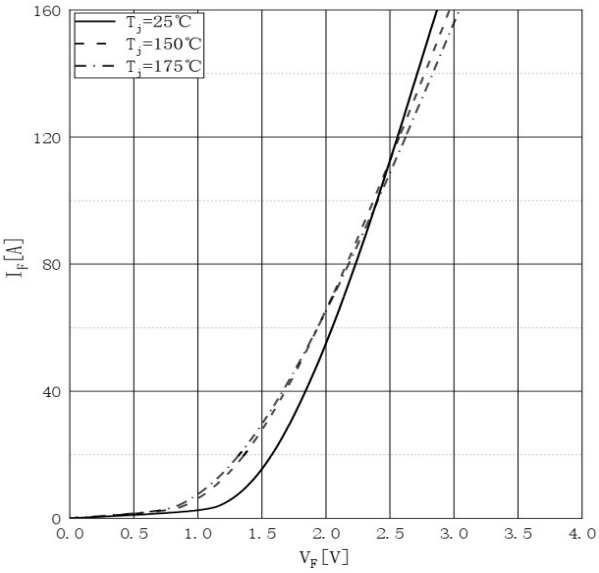


Figure 8. Diode forward current as a function of forward voltage VF vs IF

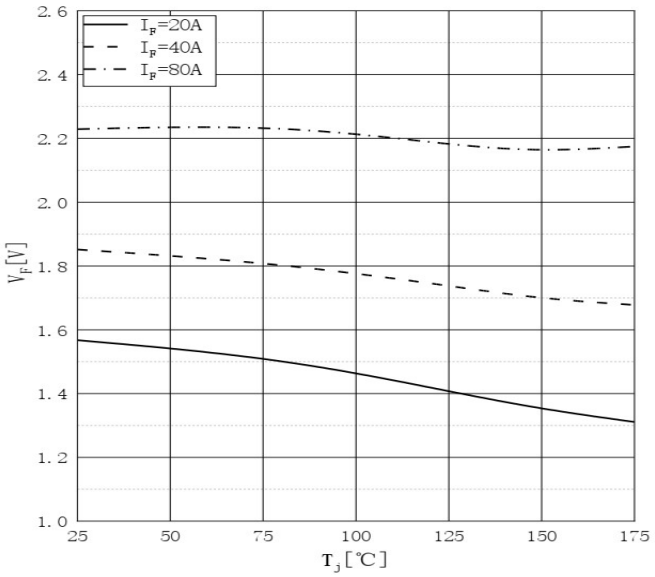


Figure 9. Diode forward voltage as a function of junction temperature VF vs Tj

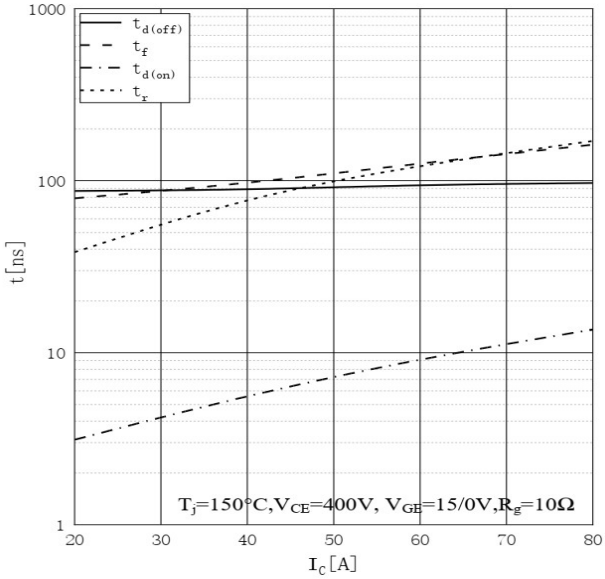


Figure 10. Switching times vs Collector current IC

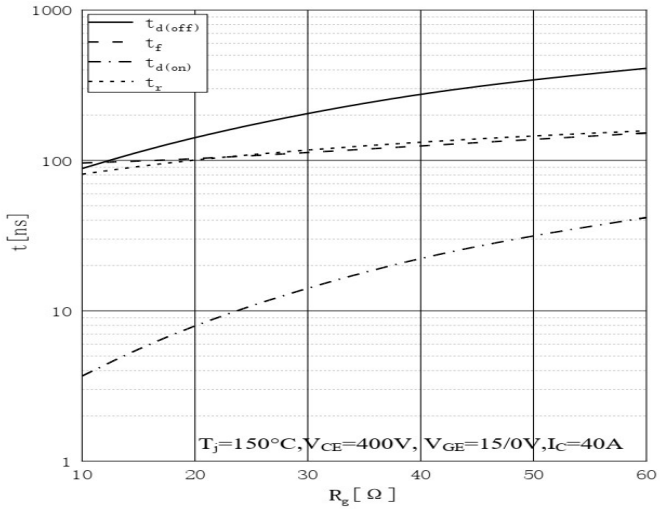


Figure 11. Switching times vs Gate resistor Rg

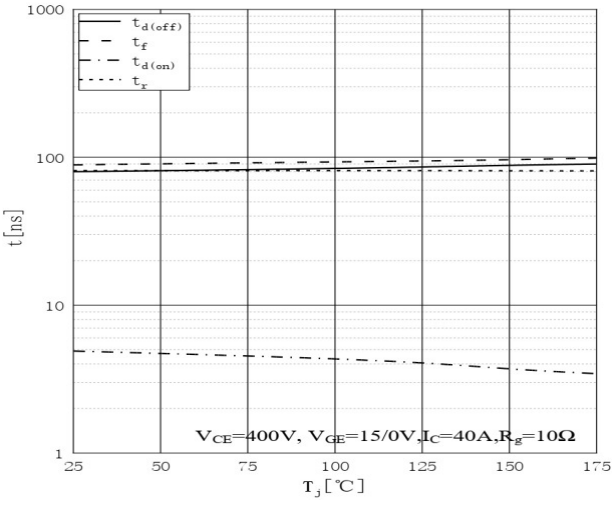


Figure 12. Switching times vs Junction temperature Tj

Typical Characteristics (TJ = 25'C unless otherwise noted) (con.)

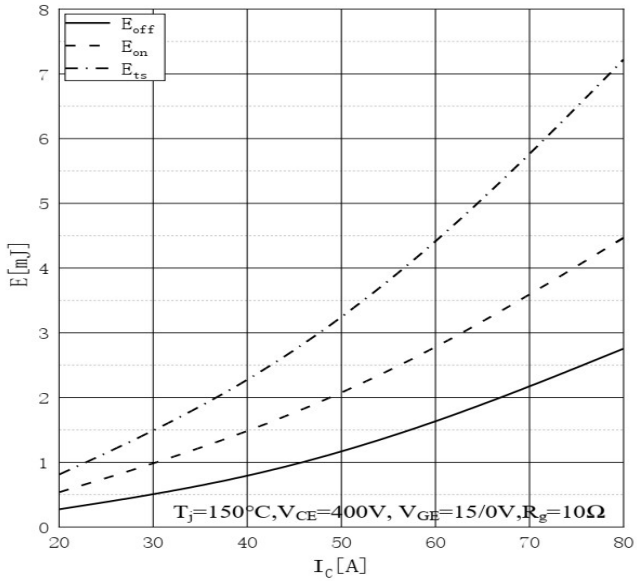


Figure 13. Switching energy loss vs Collector current IC

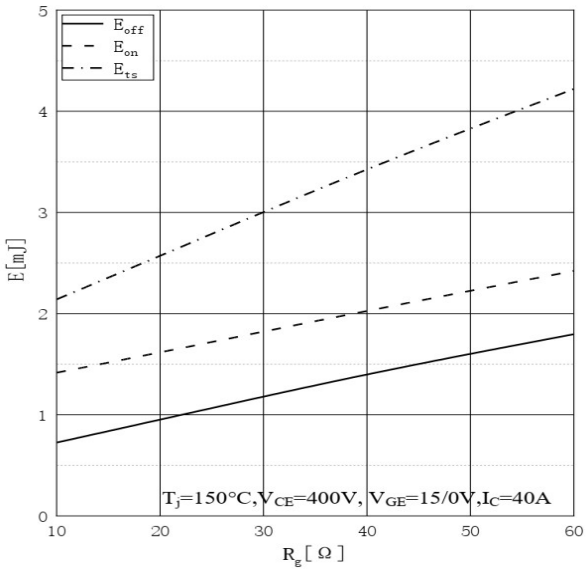


Figure 14. Switching energy loss vs Gate resistor Rg

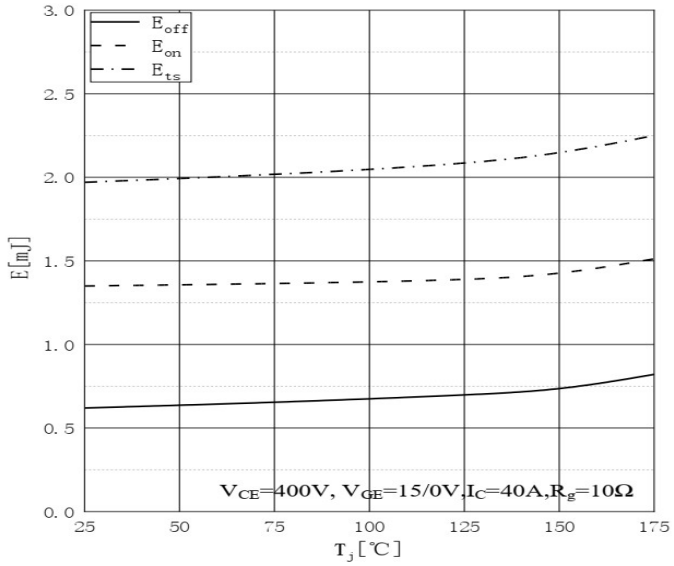


Figure 15. Switching energy loss vs Junction temperature Tj

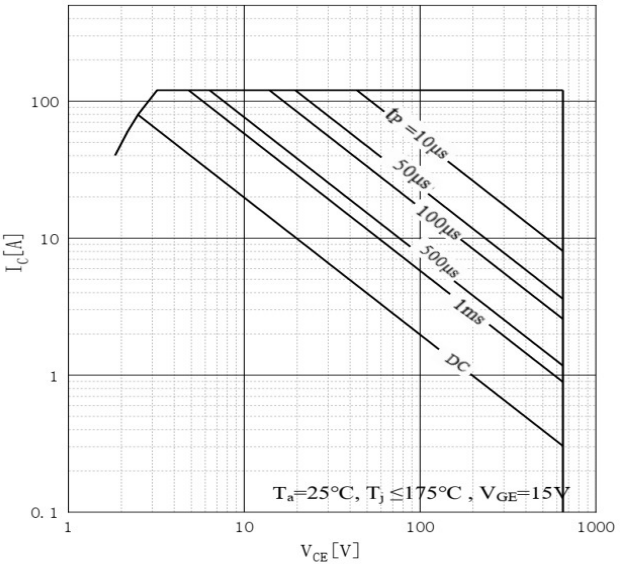


Figure 16. FBSOA characteristic

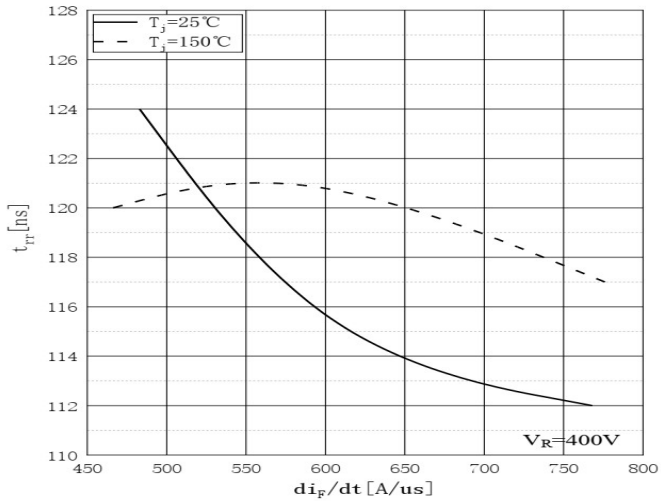


Figure 17. Reverse recovery times as a function of diode current slope trr vs diF/dt

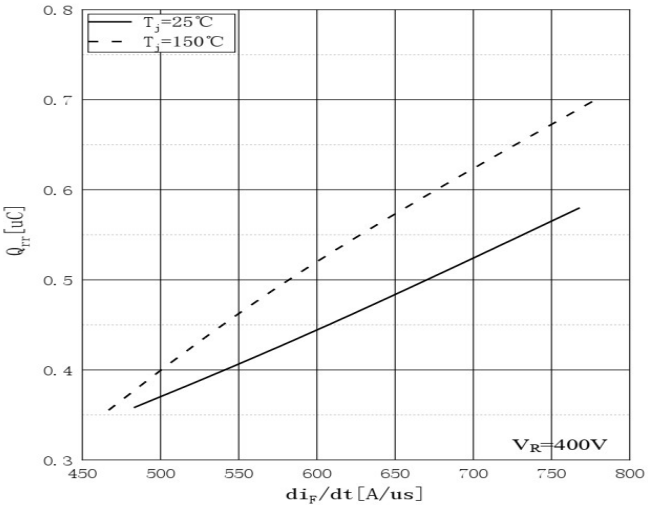


Figure 18. Reverse recovery charge as a function of diode current slope Qrr vs diF/dt

Typical Characteristics (TJ = 25'C unless otherwise noted) (con.)

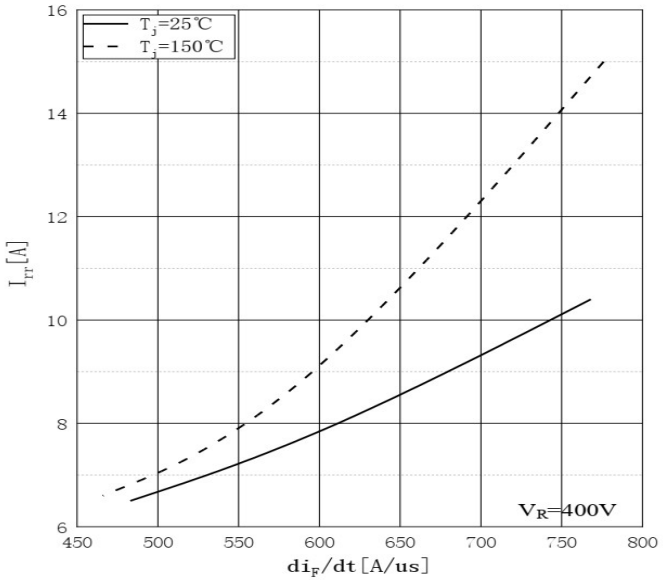


Figure 19. Reverse recovery current as a function of diode current slope Irr vs diF/dt

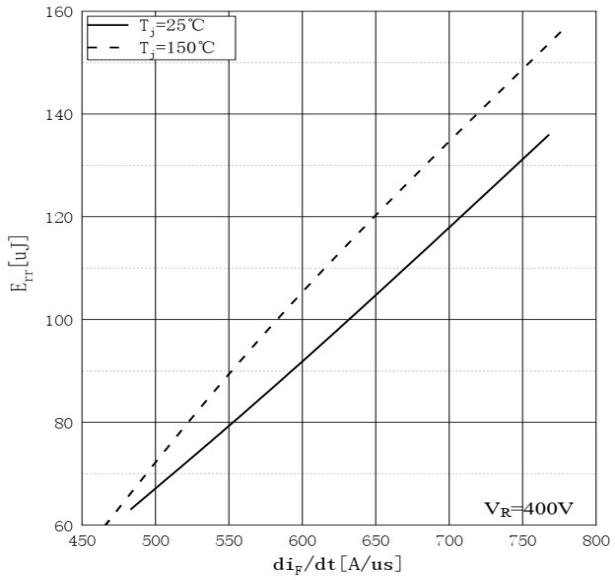


Figure 20. Reverse recovery energy as a function of diode current slope Err vs diF/dt

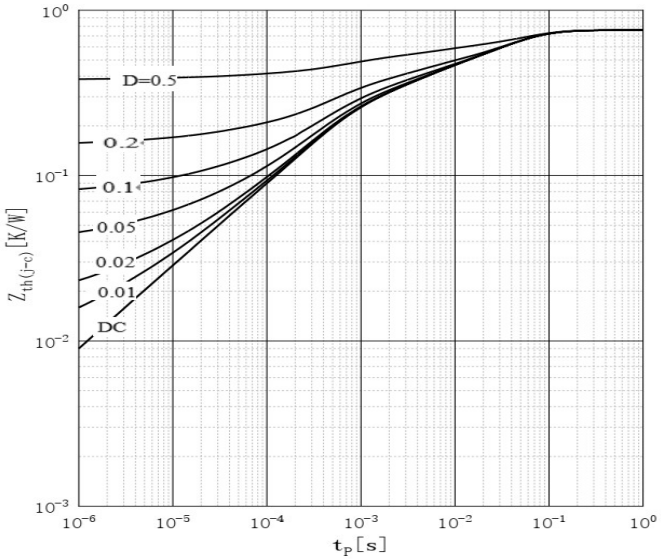


Figure 21. IGBT transient thermal impedance Zthjc

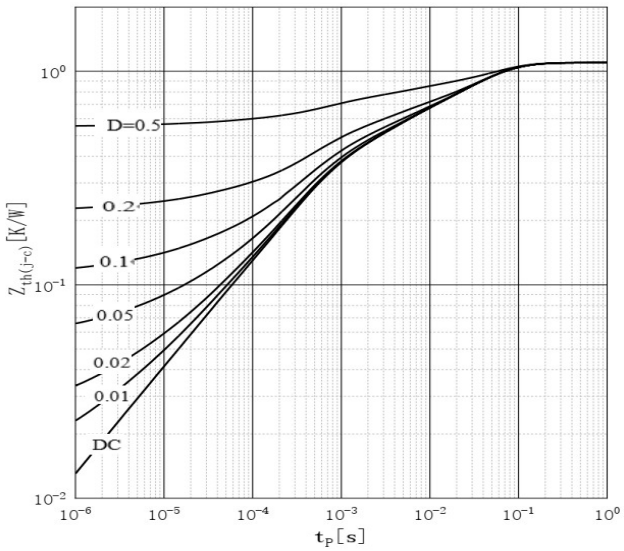


Figure 22. Diode transient thermal impedance Zthjc

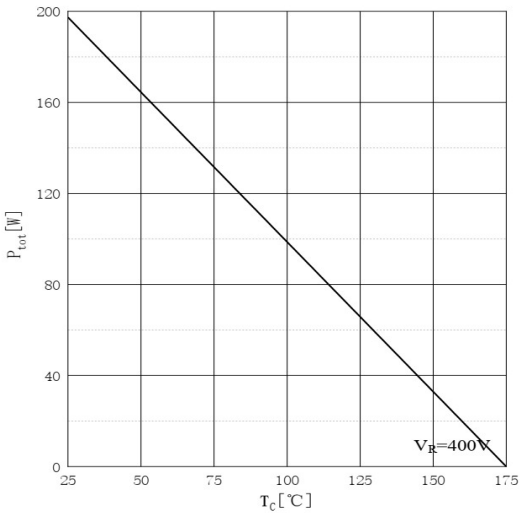
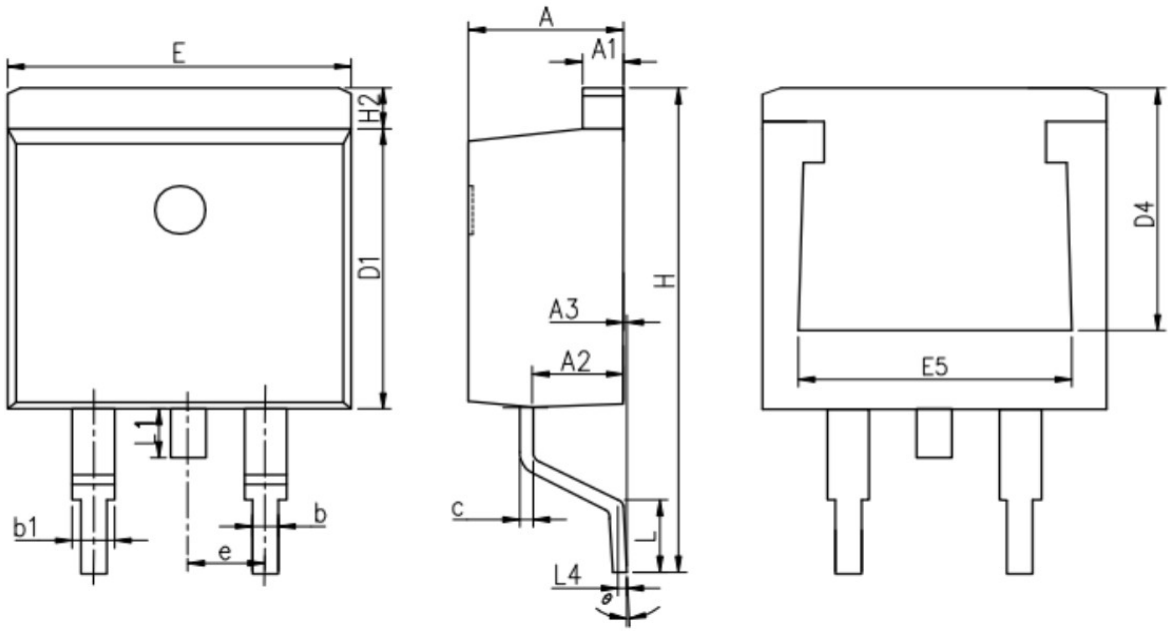


Figure 23. Power dissipation as a function of case temperature Ptot vs TC

Packaging Information

PKG: TO263-2L Package

unit : mm

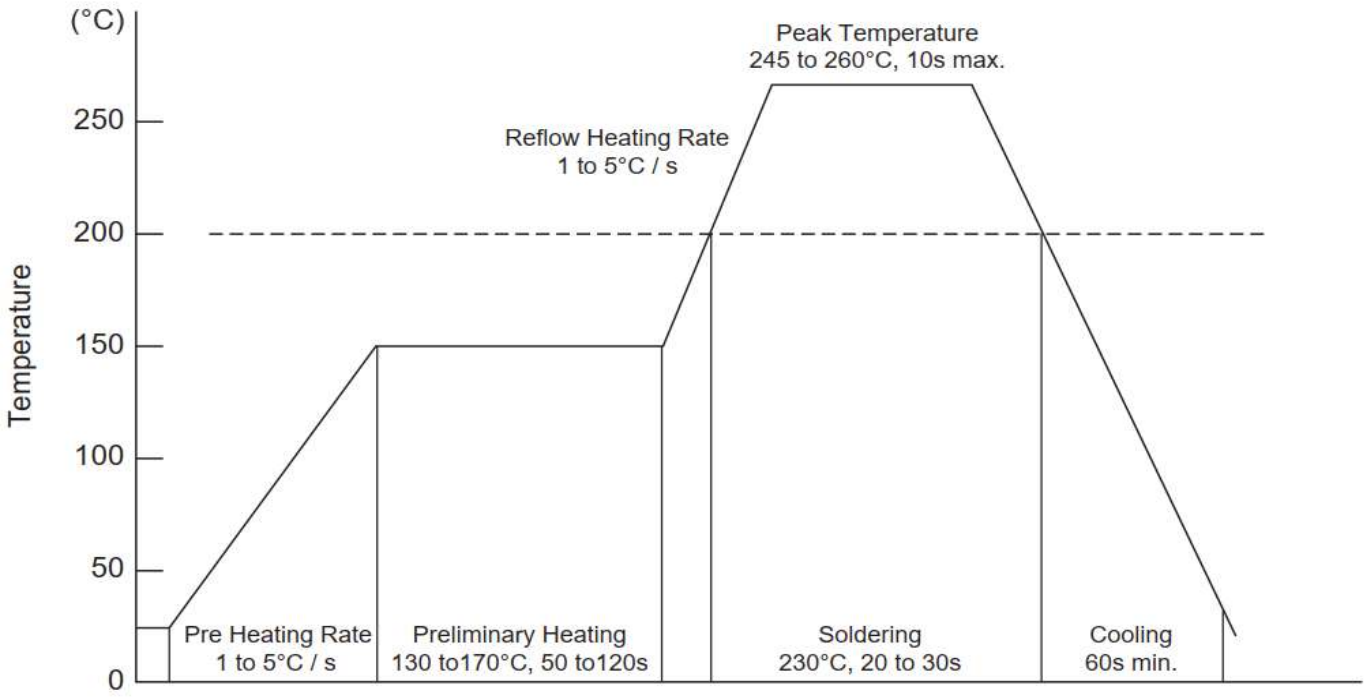


COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0	0.13	0.25
b	0.7	0.81	0.96
b1	1.17	1.27	1.47
c	0.3	0.38	0.53
D1	8.5	8.7	8.9
D4	6.6	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e		2.54 BSC	
H	14.7	15.1	15.5
H2	1.07	1.27	1.47
L	2	2.3	2.6
L1	1.4	1.55	1.7
L4		0.25 BSC	
θ	0°	5°	9°

Conditins of Soldering and Storage

* Recommended condition of reflow soldering



Recommended peak temperature is over 245'C, if peak temperature is below 245'C, you may adjust the following parameters:

* Time length of peak temperature (longer)
* Time length of soldering (longer)
* Thickness of solder paste (thicker)

* Conditions of hand soldering
  * Temperature : 300'C
  * Time : 3s max
  * Times : one time

* Storage conditions
  * Temperature
    5 to 40'C
  * Humidity
    30 to 80% RH
  * Recommended period
    One year after manufacturing